Document Number: GIFTS-01-005
Version 1.0
December 21, 2001

Geostationary Imaging Fourier Transform Spectrometer (GIFTS) – Indian Ocean METOC Imager (IOMI) Mission

Continuous Risk Management Plan

Signature Page

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Document Revision History

Revision	Date	Description
1.0	12/21/01	Baseline Initial Release 11/1/02

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1.0 Introduction

Risk is defined as an undesirable situation or circumstance that has a realistic probability of occurring and an unfavorable consequence on the overall mission success. Continuous Risk Management (CRM) is a systematic decision-making process that efficiently identifies risks, assesses risk levels, and effectively reduces or mitigates risks to achieve mission goals.

The NASA Geosynchronous Imaging Fourier Transform Spectrometer-Indian Ocean METOC Imager (GIFTS-IOMI) Continuous Risk Management (CRM) Plan defines the process and implementation of conducting CRM throughout the GIFTS-IOMI Mission (hereafter referred to as the Mission) life cycle. Implementing the Mission CRM will provide a continual risk process (identify, analyze, plan, track, and control) for all disciplines and phases ensuring communications and documentation are maintained across the entire Mission and that informed decisions can be made on a timely basis. The initial process description has been provided by NPG 7120.4B, Program/Project Management.

This CRM Plan is intended to complement overall Mission Management and therefore CRM will be an integral part of Project management. Implementation of this plan solicits inputs from everyone across the entire GIFTS-IOMI Project (hereafter referred to as the Project), with the Project Manager giving final approval for implementation of this plan.

1.1 Purpose

The purpose of this document is to describe the GIFTS-IOMI Mission CRM Plan. This plan includes descriptions of the CRM processes to carry out this effort. CRM will;

- Provide a disciplined and documented approach to risk management throughout the Project life cycle,
- Support management decision making by providing integrated risk assessments (taking into account safety, cost, schedule and performance concerns), and
- Communicate to management the significance of assessed risk levels and the decisions made with respect to them.

1.2 Scope

This document describes a process for utilizing CRM in all aspects of the Mission. CRM applies to activities, as performed by both civil servants and contractors supporting the Mission, including the launch opportunity, spacecraft, instrument, and all disciplines supporting the Mission. The objective of this effort is to formalize CRM from inception of this plan to completion of Project development, through launch and into technology validation support, throughout the Mission's complete life-cycle. In addition, the objective of CRM is to forecast and manage risks before they become problems. To the extent possible, the Mission will utilize lessons learned from other NASA projects in carrying out this CRM Plan. The CRM Plan will be reviewed at least annually and updated as required.

1.3 Document Organization

This document is organized into five major sections;

- Section 1 is an introduction and overview of this document.
- Section 2 lists parent, applicable and reference documentation.
- Section 3 provides an overview of the risk identification, analysis, and planning to be used by the Mission.
- Section 4 describes the tracking, control and reporting necessary for CRM.

- Section 5 describes the tools used to implement CRM on the Mission.
- Section 6 describes roles and responsibilities.
- Appendix A contains a list of acronyms used in this document.
- Appendix B includes documentation figures for the Risk Information Sheet including process and instructions for filling it out and the Risk Tracking Log.

2.0 Related Documentation

This section lists additional, related documents. Section 2.1 lists the parent document establishing the criteria and technical basis for this plan. Section 2.2 lists the applicable documents, this plan being in conformance with the requirements and contents of those documents. Section 2.3 lists recommended reference documents for information purposes. The GIFTS-IOMI Project Plan directs the activities of the overall project. This plan is subordinate to the Project Plan.

2.1 Parent Document

GIFTS-IOMI Project Plan, Dated TBD

2.2 Applicable Documents

NPG 7120.5A, NASA Program and Project Management Processes and Requirements, Dated April 1998

NPG 8705.x (draft), Risk Management Procedures and Guidelines, Dated

NPG 8715.3, NASA Safety Manual, Dated January 24, 2000

NPD 8700.1, NASA Policy for Safety and Mission Success, Dated June 12, 1997

2.3 Reference Documents

Carnegie Mellon University, Continuous Risk Management Guidebook, Copyright 1996

GSFC Software Assurance Technology Center (SATC), Course Materials and Workshop Materials, Dated January 1999

3.0 Risk Identification, Analysis, Planning, Tracking and Control

Performing risk identification, analysis, and planning for the Mission are the first three phases of CRM. These steps are necessary in recording and prioritizing Project risks. The following sections describe these phases for the Mission. The CRM steps are illustrated on Appendix B, Figure B-1, and the CRM process adopted by the Project is illustrated on Figure B-2.

3.1 Design for Safety (and Mission Success)

Project personnel are encouraged to consider safety throughout the Mission life cycle and focus on identifying failure modes and effects in both hardware and software. A Design for Safety program—a total systems approach which addresses safety issues as they are identified—assists in achieving this goal. Designing for safety also includes the verification processes to insure development of a safe life design. The Project depends heavily on learning and knowledge-based tools. Design for Safety begins in the concept phase and continues through the Project's life cycle. It applies to all phases of the Project and incorporates 'what if' scenarios to evaluate system hazards and their impact on system life and operation. As failure modes are discovered these tools quantitatively evaluate safety issues and assess the cost and risk of redundancy versus robustness to minimize risk. These tools are also utilized in 'what if' scenarios to identify patterns and trends and identify and analyze possible failures throughout the system's life cycle. They track problem reports, and use operational experience to update analytical models and legacy data/knowledge bases to better predict future system performance and risk.

3.2 Areas of Concern/Classification

The areas of concern, and hence the classifications to be used by the Project are as follows:

1.0 Program management,
2.0 Technologies and measurement concept,
3.0 Systems Engineering,
4.0 Payloads,
5.0 Spacecraft and launch vehicle,
6.0 Mission operations, and
7.0 Ground systems.

3.3 Risk Identification

The process of risk identification is a daily ongoing Project activity that takes place during routine Project workflow. Project activities such as programmatic and technical meetings, telecons, reviews, and other communication interchanges, will surface Project risks. When this occurs, the risk (if not previously recorded) shall be captured by placing it on a Risk Information Sheet (Appendix B, Figure B-3) for analysis and tracking.

The initial risk statement contains the risk condition, one or more consequences, and a concise context description. Performing this task provides the Mission the ability to transform uncertainties and issues into tangible and manageable risks. This also allows the Mission to identify and manage risks before they become problems.

Risk identification is the responsibility of every individual involved in the Mission. It is part of ongoing Mission activities and not a separate discipline or group of activities. The overall objective of identifying and managing Mission risks is to reduce or eliminate risks before they become problems, thus resulting in increased chances of the Mission's success.

Risks can be present in any area of the Mission. Risks are categorized as technical or programmatic. If risks are technical, they may be attributed to:

- inconsistent or incomplete requirements,
- design oversights,

- unproven technologies,
- interface or integration difficulties,
- unanticipated fault detection,
- unforeseen quality and/or safety issues, or
- insufficient resources (e.g., mass, power, data rate, computer capability)

These and other technical risks may reside with the launch opportunity, spacecraft, the instrument, the ground segment, Mission operations, technology validation data processing, or any other part of the Mission. The technical risks generally involve technical disciplines such as systems engineering, hardware and/or software engineering, parts engineering, manufacturing, or integration & test.

Programmatic risks include all risks that are not technical by nature. However, technical risks may include some attribute of a programmatic risk such as impact to cost and/or schedule. Programmatic risks generally involve management resources, communications, and decisions.

3.4 Risk Analysis

Once a Mission technical or programmatic risk has been identified and written as a risk statement (Condition; Consequence(s) + Context) on the Risk Information Sheet, it is then analyzed and prioritized.

The prioritization process is performed as a roll-up function starting at the risk element identified by the individual person and weighted through the risk process up to the Mission level. An identified risk may receive a higher prioritization at the individual component level than it would when rolled-up to the Mission level. These three identifiers for risk weighting at the Mission level are:

- **Probability** likelihood of risk occurrence
- **Impact** loss or effect on the Project if risk should materialize
- **Timeframe** time in which mitigating action must be taken to avoid the risk becoming a problem

The above three identifiers are ordered by degree of severity as follows:

IMPACT is:	If BUDGET effect is:	Or SCHEDULE SLIP is:	Or TECHNICAL effect is:
HIGH Critical impact	X ≥ 50% or X ≥ $400K	X ≥ 4 mo.	Loss of spacecraft
			Loss of instrument
			Loss of technology validation data
MODERATE Moderate impact	25% < X < 50% or $200K < X < $400K	2 < X < 4 mo.	Loss of spacecraft capability
			Loss of instrument capability or instrument subsystem
			Potential impact technology validation data
LOW Minor impact	X ≤ 25% or X ≤ $200K	X ≤ 2 mo.	Need requirement redefinition
			Need design or implementation work-around
			No loss of technology validation data

TIMEFRAME is:	Action taken within is:
NEAR TERM	0 to 2 mo.
MID TERM	2 to 6 mo.
LONG TERM	> 6 mo.

Per Appendix B, Figure B-2, the author/originator of the risk initiates the Risk Information Sheet (RIS) and provides the risk “title” and “statement”, dates it in the “identified” field, and places their name in the form’s "submitter name" field. In addition they fill in the “context” and “class” fields and send the form to the Project Risk Manager (PRM). The PRM accepts the Risk Information Sheet and logs it into the system. The PRM then forwards the RIS to the Deputy Project Manager who reviews it for completeness, makes an initial risk level evaluation (e.g., high, moderate, or low), and forwards it to the appropriate individual. For high-risk items this entails forwarding it to the Project Systems Engineer for analysis. For moderate or low risk items this entails forwarding it to the appropriate WBS Element Lead who develops the risk mitigation strategy.

The PRM brings it to the next scheduled Mission review meeting as an agenda item to be reviewed for acceptance. At the Project staff review meeting the risk impact, probability, and time frame are determined for the individual risks and these values are placed on the Risk Information Sheet.

If accepted, the Risk Information Sheet is tracked by the PRM. The identified risk is also placed on the Risk Tracking Log for tracking purposes. Appendix B includes the Risk Information Sheet template and process/instructions for filling it out.

3.4.1 Risk Matrix

The Project has established a risk matrix based on the probability, impact and timeframe as noted above. The risk matrix is presented in Appendix B, Table B-1.

3.4.2 Risk Categorization

The Project has adopted risk categorizations associated with the three major elements of the Project; namely, Technology Risk, Engineering Risk, and Programmatic Risk. These are separately identified in Appendix B, Tables B-2 through B-4, respectively.

3.4.3 Failure Modes and Effects Analysis (FMEA)

This approach is a bottom-up analysis of component-level failures and their effects on higher-level systems generally used to identify critical hardware items. All credible failure modes and their resultant effects at the component and system levels are to be identified and documented.

3.4.4 Fault Tree Analysis (FTA)

FTA uses a top-down analysis to evaluate specific undesired events. It links a top event to the combinations of sub-events that could cause it. It can verify that a FMEA has identified single failure points, and can also be used for quantitatively evaluating the probability of the top event.

3.4.5 Probabilistic Risk Analysis (PRA)

PRA provides a means for expressing quantitatively the state of knowledge about the risk of failure. Its an analysis of the probability (or frequency) of occurrence of a top-level undesired event, including an assessment and display of the degree of uncertainty surrounding the probability. It provides a basis for tradeoffs among safety, reliability, cost, performance, and other resources. It may also be used to track risk levels throughout the life cycle of the Project.

3.5 Risk Planning

In this phase of the CRM process, the appropriate WBS element lead in concert with the PM or DPM decides what action, if any, will be taken to manage/mitigate the risk or set of related risks, and there are four actions that can be assigned to a risk, these are:

- **RESEARCH** the risk to gain more information about it.
- **ACCEPT** the risk as stated and do nothing about it other than accept it.
- **WATCH** for identified "triggers" before taking any action about the risk.
- **MITIGATE** the risk to reduce or eliminate it.

4.0 Risk Tracking, Control, and Reporting

Performing risk tracking, control, and reporting for the Mission is necessary to ensure risks are tracked and are not lost in the process. The following paragraphs describe these phases of the Project's CRM process.

4.1 Risk Tracking

In the risk tracking phase the risk owner acquires, compiles, and reports information on selected risks. This phase is necessary to collect accurate, timely, and relevant Project risk information and to present it in a clear manner. This information shall be provided at a designated Project Management Meeting (on a monthly basis). This information shall also be provided in Project review reports along with other Project status information.

Individuals and groups shall identify/document risks and shall track/report each risk to Project management. Ultimately the Project Manager controls risks within the Project, and provides status to upper management. Any risk that is of high priority and needs support beyond the Project's capability will be brought to upper management's attention for their support and/or resolution.

Important Mission technical and programmatic risks addressed by mitigation planning shall be monitored and tracked by the PRM for reduction and/or risk closure. This process shall attempt to provide some method of measurement to show progress toward achieving the prescribed goal. An example would be to eliminate TBDs in a requirements document by a specific date. One method of showing progress would be to count the number of TBDs and report periodically on how many have been closed until the end object is achieved.

Each identified Project risk that is to be mitigated with a risk plan shall address how progress towards reduction or closure can be measured. Only meaningful current data should be collected and measured for any given Project risk.

4.2 Risk Control

During the controlling phase, informed, timely, and effective decisions are to be made regarding risks and their mitigation plans. Risk control is performed using standard Mission management monitoring techniques. Controlling risks will be integrated and coordinated in the Mission's routine management activities.

The following are mitigation plan decisions:

- Replan
- Close the risk
- Invoke a contingency plan
- Continue tracking and executing the current plan

The decisions to proceed on mitigation planning are essential and require current accurate data to effectively make the right decisions in the control phase. The final decisions on risk mitigation planning will be made by the PM or designee.

4.3 Risk Reporting

Reporting risks on the Project provides personnel an understanding of the Mission's overall status with regard to risks and mitigation alternatives. Successful risk reporting raises the level of understanding of relevant issues or actions. CRM reporting has the following characteristics:

- Free flow of information between individuals, groups, and the GIFTS-IOMI Organization,

- Inclusion of formal, informal, and impromptu communications,
- Value of individual contributions, and
- Application of consensus voting of teams.

The Risk Information Sheet and Risk Tracking Log shall be used, maintained, and controlled throughout the Project's CRM process. This information will be available and reviewed by Project personnel on a periodic basis.

The Mission has a Web Site providing access to risk status information. This is accomplished by using MesaVista.

4.4 Program Reviews and Milestones

Risk reviews and/or coordination meetings are at the discretion of the GIFTS-IOMI Deputy Project Manager. Risks may be reviewed weekly, bi-weekly, or monthly depending on the number and criticality of the risks identified. For instance, risks may be reviewed during the weekly System Engineering and Integration Team meeting, which are led by the GIFTS-IOMI Project Manager.

4.4.1 Milestones

- Weekly project and WBS element meetings shall include a report of risk status.
- Monthly project meetings shall include a report of risk status.
- Top 20% risk status shall be summarized and reported to the Project Manager on a monthly basis.
- The baseline set of risks shall be reestablished on a project milestone basis.
- Top 10 risks shall be reported monthly.

4.5 Resources

Resources for the management of risks are broken into two categories:
- Overhead costs associated with the risk management process: 0.05% of the project budget
- Mitigation plan costs: resources associated with mitigation plans, specifically those with task plans.

Budget allocation for mitigation plan development and execution is initially set at 1% of the project budget, with equal portions distributed to each Work Breakdown Structure (WBS) Element Manager. Each WBS Element Manager is responsible for managing their mitigation budget. Any requirements for additional mitigation resources must be made to the Project Manager.

5.0 Risk Management Tools and Implementation

This Section identifies the tools that will be used for CRM by the Mission. These tools are utilized throughout the Project life-cycle for technical and programmatic risks. The tools are used by individuals, teams and management in identifying, analyzing, planning, tracking, and controlling Project risks. The following tools are specifically used by the Project:

5.1 CRM Training

Project personnel have participated in a training session on CRM provided by the LaRC OMA. This session provided the CRM methods and tools needed and identified in this plan. Any additional classes needed for future CRM training will be coordinated between the PM, PRM, and LaRC OMA.

5.2 Risk Management Plan (this document)

Documents how CRM will be implemented for the Mission. This plan will be maintained by the PRM, reviewed at least annually, and updated as required. It is the PRM's responsibility with the Project Manager's support to ensure that this plan is implemented.

5.3 Risk Information Sheet (see Appendix B, Figure B-3)

This is the initial means of identifying and documenting a risk. The form is maintained throughout the life of an identified risk, and information is added to the form as it is known and available. Appendix B includes the form template and process/instructions for filling the form out. Completed forms will be maintained by the PRM in a database system under Configuration Management (CM).

5.4 Risk Tracking Log (see Appendix B, Figure B-4)

This list provides a risk number, title, and quick look-up for all identified and accepted Project risks. The list identifies a responsible person and due date for the risk that serves as a tickler file until risks are closed. The PRM, with clerical support, is responsible for updating, maintaining, and disseminating this list.

5.5 Project Metrics

There are various types of metrics supporting both technical and programmatic activities. The Project has been using metrics in estimating and showing progress within the Project. This effort will continue and will be used in risk management for risk monitoring, tracking, forecasting, and reporting.

5.6 Risk Management Tools

There are several tools available for evaluating and tracking/categorizing risks. Tools that support tracking and categorizing risks include the NASA Risk Management System and Mesa-Vista. The risk tracking and categorization tool is under the supervision of the Project Risk Manager. The selected tool has the capability to generate metric reports such as number of open/closed risks, number of high risks, and etc.

5.7 Mitigation Plans

These plans will be developed for a risk or set of risks (similar within the same family/closely related) that require significant resources to reduce or close the risk(s). Information required for a mitigation plan (technical and/or programmatic) includes:

- Title and number of the Project risk(s) as on the Risk Information Sheet,
- Description of how the risk(s) will be mitigated and measurement used to indicate progress. Provide method and frequency of reporting progress and status, and
- Schedule and resources (hours, dollars, etc.) needed to implement the mitigation plan; the individual responsible for the activity; and Project Manager approval to implement the mitigation plan.

5.8 Project Formal/Informal Meetings

All Project formal and informal meetings shall have CRM as a topic on the agenda when it is appropriate. These meetings are the means of providing the most effective communications to the Project on CRM. Several tools are available and will be used within meetings. They range from simple Brainstorming, Multivoting and Voluntary Risk Reporting to more formal Stoplight Charts, Bar Graphs, and PERT Charts.

6.0 Roles and Responsibilities

6.1 Project Manager (PM);

- Owner of the Risk Management Process
- Allocates funding and resources to mitigate risks
- Reviews and approves all risks and their mitigation strategies that affect Level 1 requirements and/or PCA
- Closes Level 1 risks
- Maintains and periodically reviews status of the top ten Project risks

6.2 Deputy Project Manager (DPM);

- Reviews all risks
- Categorizes and prioritizes the level of risk
- Establishes a timetable for risk mitigation strategy development
- Reviews risk mitigation strategies
- Approves mitigation strategies for Level 2 and below
- Assigns the owner for all risks
- Closes Level 2 risks and below
- Periodically reviews the status of the top N risks

6.3 Project Risk Manager (PRM);

- Controls and maintains the risk database
- Reviews the paperless Risk Information Sheet
- Provides training to Project personnel
- Assists the DPM in tracking risks and generates reports
- Presents all new risks at Project reviews (weekly or monthly)

6.4 Systems Engineering;

- Conducts risk analysis
- Supports status reviews
- Supports the DPM on risk categorization

6.5 WBS Element Manager;

- Develops risk mitigation strategies
- Presents strategies for approval
- Periodically reviews status of all risks on the element

6.6 Risk Owner;

- Executes the mitigation strategies
- Maintains report status of the risk(s)
- Immediately notifies the WBS Element Manager of any significant changes in status
- Keeps the database up-to-date
- Supports the WBS Element Manager in developing mitigation strategies

6.7 All Individual Project Team Members;

- Identifies risk(s)
- Initiates the paperless Risk Information Sheet
- Supports the development of mitigation strategies
- Supports the RM in initiating Risk Information Sheets

6.8 Office of Safety and Mission Assurance (OSMA);

- Manages the PRM
- Maintains necessary hardware/software facilities
- Provides data integrity and security

Appendix A - Acronyms

This appendix contains an alphabetical list of all acronyms used in this document.

CCB	Configuration Control Board
CM	Configuration Management
CRM	Continuous Risk Management
DPM	Deputy Project Manager
EOS	Earth Observing System
ESSP	Earth System Science Pathfinder
FMEA	Failure Modes and Effects Analysis
FTA	Fault Tree Analysis
GIFTS	Geostationary Imaging Fourier Transform Spectrometer
GSFC	Goddard Space Flight Center
IOMI	Indian Ocean METOC Imager
LaRC	Langley Research Center
METOC	Meteorological and Oceanographic Center
NASA	National Aeronautics and Space Administration
NPG	NASA Procedures and Guidelines
NASA	National Aeronautics and Space Administration
OMA	Office of Mission Assurance
OSMA	Office of Safety and Mission Assurance
PCA	Project Control Authority
PM	Project Manager
PRA	Probabilistic Risk Analysis
PRM	Project Risk Manager
RIS	Risk Identification Sheet
SATC	Software Assurance Technology Center
TBD	To Be Determined
WBS	Work Breakdown Structure

Appendix B - Processing/Completing the Risk Information Sheet and Document Figures

Processing/Completing the Risk Information Sheet (see attached)

Step 1: This form is initiated by the risk author/originator (including all Project personnel) by completing the following entries:

- *"Identified"* Date when the risk was identified
- *"Title"* Short title identifying the risk
- *"Statement"* Statement of the risk consisting of condition and consequence(s)
- *"Submitter Name"* Person or organization that identified the risk
- *"Context"* Associated information supporting the risk
- *"Class"* **Tech** for technical, **Prog** for programmatic, **Grd** for ground, **Lnch** for launch opportunity, **Spa** for spacecraft, or **Ins** for instrument.

If the author/originator is aware of any additional risk information at the time of submittal to the PRM, such information should be attached for evaluating and processing the RIS. Once the RIS has at least the six required fields filled completed, it is accepted by the PRM for processing.

Step 2 The PRM accepts the RIS, denotes it with a unique number in the risk "ID" Field and logs the RIS on the RTL. The "ID" field will be an "R" followed by a dash, the last two digits from the year, followed by a dash and a sequential number from 1 to 99.

For example, the first risk identified in the year 2000 is R-00-01.

If additional information appears needed, the RIS will be returned to the author/originator for resubmission.

Step 3 The PRM forwards the RIS to the DPM who conducts an initial risk evaluation (e.g., classifies the risk as high, moderate, or low). The DPM holds the risk form along with any other risk forms for a CRM Project review. The review may be a separate CRM Review Board or may be in combination with the Configuration Control Board (CCB) or other activity such as the GIFTS-IOMI Management Meetings.

Step 4 At the CRM Project Review the staff will review the risk submittal for completeness and acceptance. The risk submittal is then placed on the Risk Tracking Log (Appendix B, Figure B-4) for tracking. If the risk submittal is rejected the originator is notified along with the rationale and the assigned number closed/rejected.

Minutes of the Project review are taken and all risk actions are facilitated and/or tracked by the PRM. The PRM ensures that the WEB Site reflects all updates of risk information. The Project staff will review the status of the Risk Tracking Log and the PM has ultimate responsibility for approving mitigation plans, and closing completed risks. Special topics dealing with CRM may require other individuals to support staff meetings as needed. The remaining fields on the risk form are incorporated at acceptance and during tracking and closure:

- "Priority" priority ranking of the risk
- "Probability" the likelihood of risk occurrence
- "Impact" the severity if risk should materialize
- "Timeframe" time to start action or mitigation
- "Assigned to" who is responsible for this risk

- "Mitigation strategy" , "Contingency plan and trigger" strategy if mitigation is used
- "Status/status date" update of actions and changes
- "Approval", "Closing date", and "Closing rationale" approval of closure and rationale

Step 5 Once accepted, the Risk Information Sheets are maintained and tracked to closure and kept on file. The Risk Tracking Log provides status and a quick look-up for overall progress. The PRM will maintain records for all CRM activity, and, with OSMA support, keep the Risk Management up-to-date.

Document Figures:

Figure B-1 Risk Management Steps

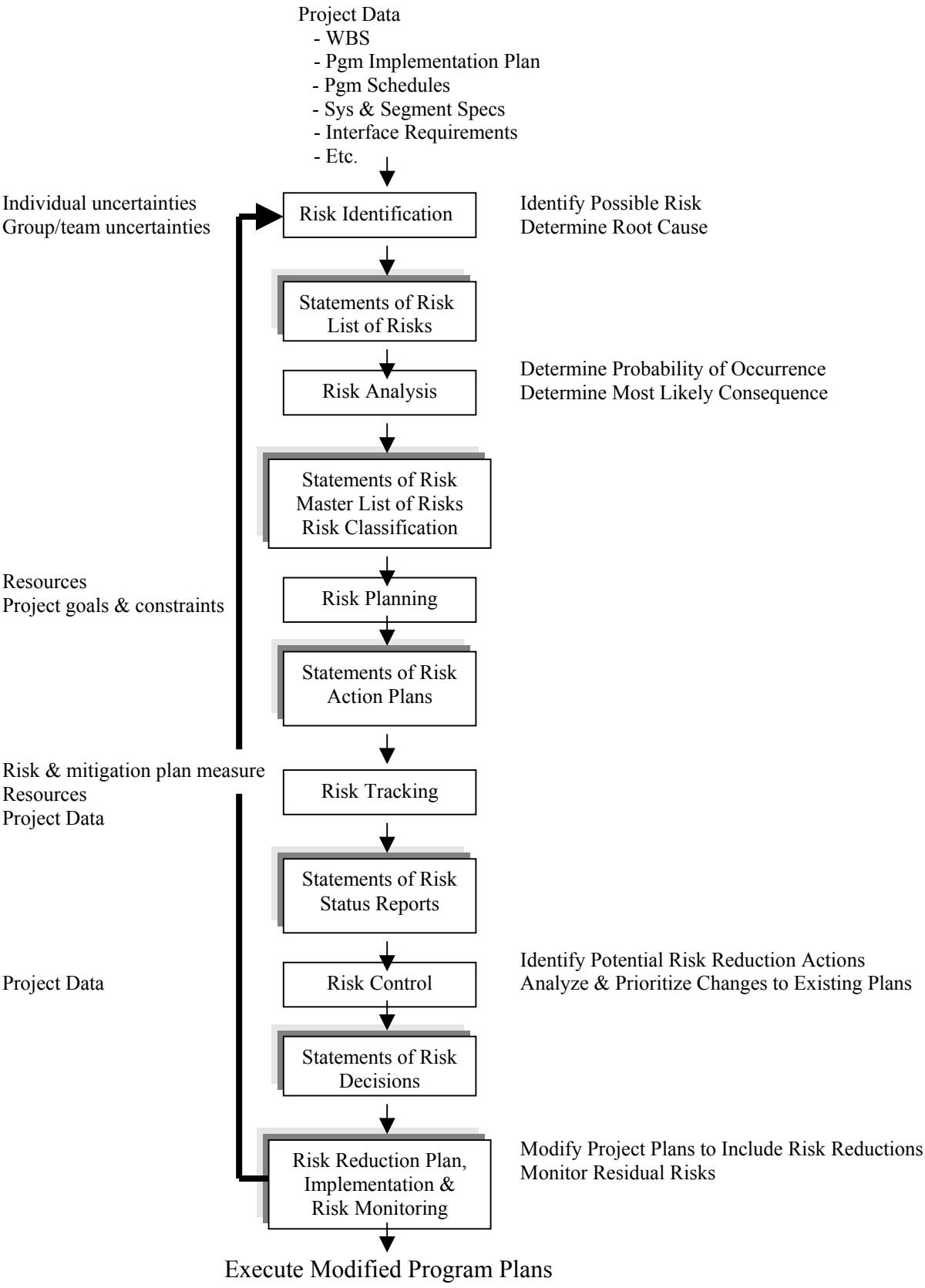

Figure B-2 Continuous Risk Management Process Flow

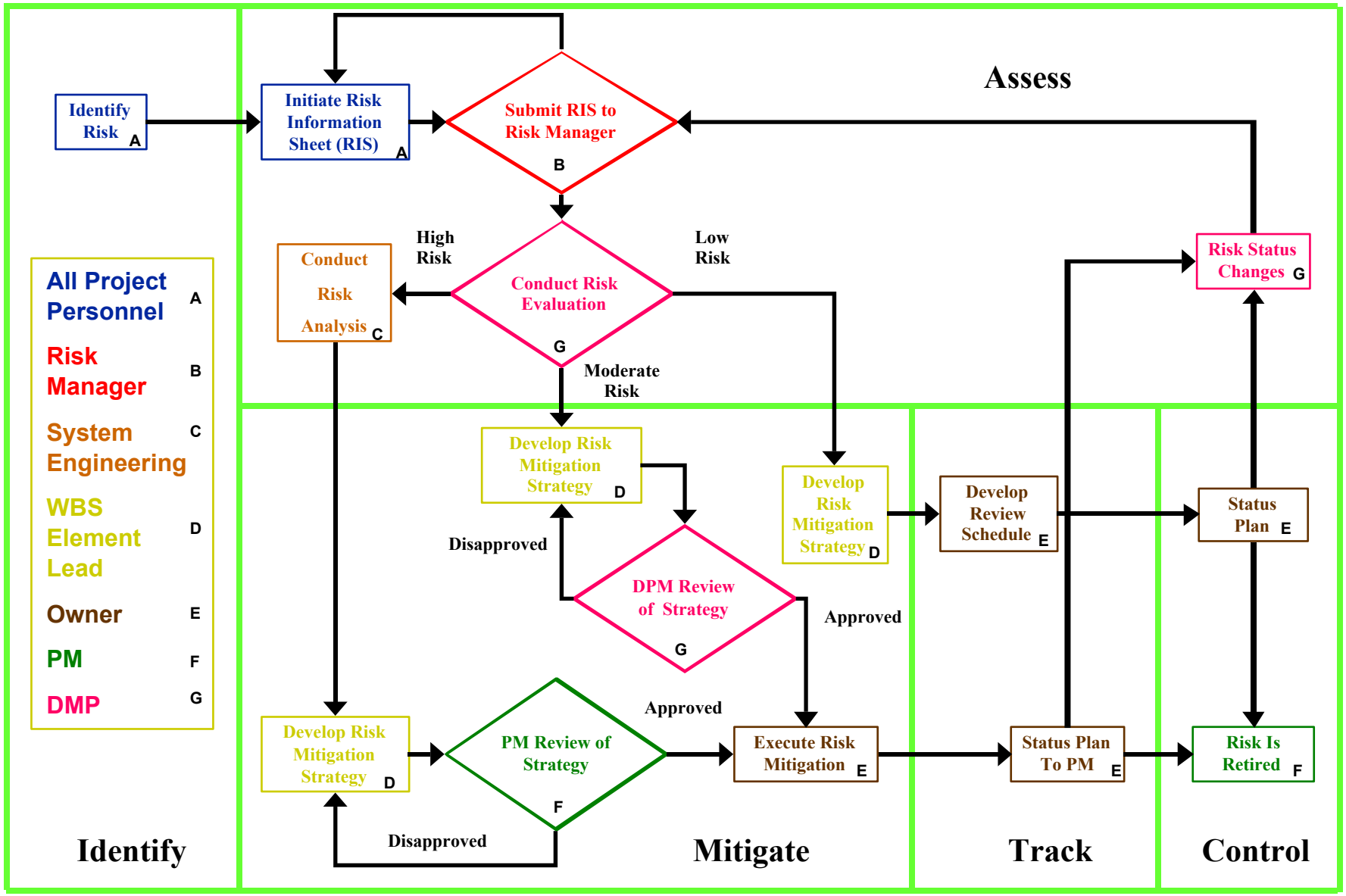

Figure B-3 Risk Information Sheet

<table>
<tr><td>ID</td><td colspan="2">Risk Title:</td><td>Origination Date:</td></tr>
<tr><td>Priority</td><td colspan="3" rowspan="3">Risk Statement (Condition and Consequence):</td></tr>
<tr><td>Probability (P)</td></tr>
<tr><td>Impact (I)</td></tr>
<tr><td>Timeframe (T)</td><td>Submitter’s Name:</td><td>Class</td><td>Assigned to</td></tr>
<tr><td colspan="4">Context:
•</td></tr>
<tr><td colspan="4">Mitigation Strategy:</td></tr>
<tr><td colspan="4">Trigger</td></tr>
<tr><td colspan="4">Contingency Plan</td></tr>
<tr><td colspan="3">Status</td><td>Status Date</td></tr>
<tr><td>Approval</td><td>Closing Date</td><td colspan="2">Closing Rationale</td></tr>
</table>

Figure B-3

Table B-1 Risk Matrix

Time Frame - Near

Impact	Probability: High	Probability: Medium	Probability: Low
High	High	High	Medium
Medium	High	High	Medium
Low	Medium	Medium	Low

Time Frame - Mid

Impact	Probability: High	Probability: Medium	Probability: Low
High	High	High	Medium
Medium	High	Medium	Low
Low	Medium	Low	Low

Time Frame - Far

Impact	Probability: High	Probability: Medium	Probability: Low
High	High	Medium	Low
Medium	Medium	Medium	Low
Low	Medium	Low	Low

Table B-2 Technology Risk Probabilities

Risk Driver Category	Probabilities for Technology Risks		
	Low (C)	Medium (B)	High (A)
Technology Status	TRL ≥ 7 by MCR TRL ≥ 6 at selection	TRL ≥ 7 by CDR TRL ≥ 6 by MCR TRL ≥ 5 at selection	TRL ≥ 6 by CDR TRL ≥ 5 by MCR TRL ≥ 4 at selection
Complexity	Technology designs simple and/or consist of few parts. S/W consists of few modules.	Technology design moderately complex and/or consists of multiple parts. S/W consists of multiple modules.	Technology designs highly complex and uncertain and/or consists of multiple highly integrated parts. S/W is highly complex and consists of multiple modules
Dependencies	Independent of other technologies	Dependent on proven technologies, equipment, and/or test data	Dependent on unproven technologies and/or unavailable test data
Testability/ Verifiability	Technology performance can be fully tested/verified using existing data/information	Test/verification of technology performance requires development of new data/info; all adverse conditions can be modeled	Technology performance can't be tested/verified under all adverse conditions
Maintainability	Only minor changes to existing support technologies and/or procedures required	Substantial modifications may be required to existing support technologies/procedures	New support technologies and procedures will be required

Table B-3 Engineering Risk Probabilities

Risk Driver Category	Probabilities for Engineering Risk		
	Low (C)	Medium (B)	High (A)
Required Technical Advancement	Use of existing h/w & s/w or minor modifications	Use existing h/w and s/w with major mods; use of existing s/w with some new modules/code development	State of the art or beyond
Technology Status	In use or prototype exists	Under development	Concept stage
Complexity	Technology designs simple and/or consist of few parts. S/W consists of few modules.	Technology design moderately complex and/or consists of multiple parts. S/W consists of multiple modules.	Technology designs highly complex and uncertain and/or consists of multiple highly integrated parts. S/W is highly complex and consists of multiple modules
Dependencies	Independent of other technologies	Dependent on proven technologies, equipment, and/or test data	Dependent on unproven technologies and/or unavailable test data
Testability/ Verifiability	Technology performance can be fully tested/verified using existing data/information	Test/verification of technology performance requires development of new data/info; all adverse conditions can be modeled	Technology performance can't be tested/verified under all adverse conditions
Maintainability	Only minor changes to existing support technologies and/or procedures required	Substantial modifications may be required to existing support technologies/procedures	New support technologies and procedures will be required

Table B-4 Programmatic Risk Probabilities

Risk Driver Category	Probabilities for Programmatic Risk		
	Low (C)	Medium (B)	High (A)
Required Facilities	Existing facilities identified, operational, and agreements in place	Not all facilities identified or fully operational. Agreements not finalized	Facilities don't exist or not operational. No agreements are in place
Resources – Budget	Appropriate level of funding has been allocated, on time, to complete task	Some small level of funding has been/will be relocated from the task	Appropriate level of funding has not been allocated to complete the task
Resources – Personnel	Personnel are available for the duration of the task. Personnel have successfully developed this type of technology in the past.	Personnel not available for the duration of the task, some key personnel may retire or change jobs during the task. Personnel have some experience developing new technologies	Personnel not available. Personnel assigned to the Project have no experience developing new technologies
Schedule	Task not in the critical path	Task in the critical path, but some slack available	Task in the critical path with no slack
Requirements	All requirements clearly defined	One or two requirements have not been adequately defined	More than two requirements have not been adequately defined
Management	All agreements identified and completed, all plans approved, all interfaces and controls are in place	Agreements identified but not finalized, some of the plans are not approved, not all the interfaces and controls are in place	No agreements are finalized. No plans are approved. None of the interface controls are in place